News

Triple DNA helix in gas phase identified

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Scientists in Spain have effectively extracted structural information from a triple helix deoxyribonucleic acid (DNA) in a vacuum-like condition (i.e. its gas phase). Presented in the Journal of the American Chemical Society (JACS), the study could help fuel antigen treatments based on these DNA structures.

The Institute for Research in Biomedicine (IRB Barcelona) and the Barcelona Supercomputing Center (BSC) researchers said no one had ever succeeded in identifying these particular DNA structures before.

'Until now, these special DNA structures were almost impossible to detect and it was not known whether they preserved structural memory in solution when they were evaporated,' says Professor Modesto Orozco of the University of Barcelona, who also heads up the Life Sciences unit at BSC. 'With this study we have characterised this structure and demonstrated that it maintains a surprising memory of its previous biological environment, aqueous solution, in which it is normally very difficult to characterise.'

Professor Orozco and colleagues used computational simulation techniques with experimental validation through mass spectrometry to get the results they wanted. The BSC researcher and his team have been working on this effort for over 10 years. This latest finding helped the team secure the complete atlas of classical DNA structures in gas phase.

This study could help scientists develop the so-called antigen therapy. According to the researchers, using the DNA triple helix structures in treatment means the active genes that contribute to a given disease would be switched off.

'There is still no drug based on gene therapy in the market, but several are under development,' says Professor Orozco, adding that one of the challenges in making the treatment a reality lies in the difficulty to experimentally detect these triple helix structures. 'Demonstration that the structure is maintained in gas phase will allow these DNA structures to be detected more easily,' Professor Orozco says.

This work will give scientists the tool they need to implement novel structural resolution techniques based on the use of X-ray free-electron lasers (X-FELs). The European XFEL, a facility being constructed in Germany, will generate intense light pulses, ones that are comparable to a synchrotron. 'If our calculations are correct, X-FEL could be used to obtain structural data in gas phase about the behaviour of a molecule in its natural biological environment and X-FEL would become a very powerful tool to resolve the structure of macromolecules,' the BSC scientist says.

Experts from the University of Liège in Belgium contributed to this study.

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